

Accordingly, after a brief introduction, M. Olivier discusses the representation of the point, the straight line, and the plane, and the elementary problems relating to them. What is offered instead of this to the English student? Rules for finding the plan and elevation of an equilateral triangle, of a cube, octahedron, &c., in various specified positions, with a very few really fundamental problems apologetically inserted here and there. Now although the representation of a few concrete solids may be useful to help the beginner to see the object of orthogonal projection, a text-book wholly, or almost wholly, devoted to such special problems is of very little use, except for the passing of examinations set exclusively on these lines.

Similar remarks might be justly applied to most of our books on practical plane geometry and perspective. The almost invariable rule is to give a more or less numerous set of isolated examples, all worked out, with as little discussion of principles as possible: the result is that the student, instead of being provided with a powerful instrument capable of endless adaptation, is merely acquainted with a bundle of dry practical rules.

The works which have suggested these observations are by no means the worst of their class: on the contrary, they are much better than the average, and mark, it is to be hoped, a movement in the direction of reform.

Captain Atkinson's book is intended chiefly for the Royal Military Academy, and its scope has doubtless been dictated by this consideration. Its principal merit is that it contains three chapters on horizontal projection (*i.e.* the method of an indexed plan) which really do give a useful and practical outline of this method in an orderly way. Most of the elementary problems are solved, and the examples appear to be well chosen. It would have been a good plan to give the data of some unworked problems graphically instead of stating them all in words. The earlier part of the book is less attractive; it contains a bare outline of orthogonal projection and a few miscellaneous notes on regular solids, ways of drawing an ellipse, &c. The book ends with a sketch of the method of isometric projection. The plates are clear: unfortunately they are printed on folded sheets, and bound up at the end of the book; this makes it very difficult to follow a figure and the text relating to it simultaneously. If the plates were bound separately the convenience of the work would be greatly increased.

Mr. Plant discusses a great variety of problems, which have been arranged in groups in a fairly systematic way. The figures are from photographs of actual drawings by the author and his assistants, and so afford the student a real practical standard of accuracy. The book is likely to be very useful to the classes for whom it is intended: at the same time, there are several points on which it appears to us rather open to criticism.

In the first place, the attention given to different groups of problems is not proportional to their importance. At least half of the problems in sections G to K might have been set as exercises; this would have given space for a discussion of similar figures—an important subject almost ignored.

Again, the use of set squares for drawing parallels receives no attention, although these instruments are

casually mentioned in the introduction. Nothing is more essential to the draftsman than familiarity with the use of set squares; compass constructions (such as those given in this book) for drawing parallels and perpendiculars are seldom used in practical work.

In a similar way, the use of the protractor for setting off angles is not sufficiently brought out. There is actually a section on the construction of certain special angles (such as $67^{\circ} 30'$) without a protractor. The section on regular polygons is specially unsatisfactory: there may be some sense in giving an accurate compass construction for a pentagon, but what earthly use is there in giving *incorrect* constructions (*e.g.* for the heptagon, p. 30 and elsewhere) which only afford an approximation obtainable much more simply by means of a protractor or scale of chords, or even by a method of trial? It may be added that these approximate constructions are given without any warning of their real inaccuracy.

Finally, there are a good many examples of no practical importance: for instance, group J is "To inscribe a square in all (!) the figures capable of containing it." Of course when questions of this kind turn up as Euclid riders, it is a good thing to make a schoolboy draw an accurate figure; but to include them in a text-book of practical geometry is waste of space.

The fact is that ideal treatises on practical geometry in all its branches, for the use of English students, have yet to be written. Ordinary plane geometry, orthogonal projection, perspective and projective geometry—all these are methods of extreme value, both to the mathematician and to the engineer, when they are really mastered; but a mere smattering is of very little use. Unless you know thoroughly the elementary principles involved, the solution of hundreds of isolated examples is little better than waste of time: here, as elsewhere, an ounce of theory is worth a ton of "practice" of the usual kind. Real practice, of course, is indispensable; but it should be systematic, and illustrate principles of general application.

G. B. M.

OUR BOOK SHELF.

Michael Faraday: His Life and Work. By Silvanus P. Thompson, D.Sc., F.R.S. Pp. ix + 308. "The Century Science Series." (London: Cassell and Co., Ltd., 1898.)

THE lives of men to whose genius and untiring devotion to research the stately edifice of modern science owes its existence, have a fascination and an interest which appeal to a much wider circle than that of the few who are able to realise the full significance of their epoch-making scientific discoveries. Even those to whom science is little more than a name are capable of feeling a keen interest in everything that concerns the purely human element in the lives of the great leaders in science. Hence there has arisen a demand for biographical literature of this type, a demand which the "Century Science Series," to which the volume before us is the latest addition, is intended to meet.

Of all the great names in the history of science which have become household words in civilised communities, that of Michael Faraday will always stand out pre-eminently as that of one in whom genius was wedded to a childlike simplicity and transparent sincerity of character but seldom found in association with such remarkable

powers of the intellect. Faraday's career was a truly remarkable one, judged from almost every point of view. Deprived of all the advantages of a careful training in early life, and commencing the study of science at an age when the deficiencies of early education are not easily remedied, he yet, by strenuous effort and single-minded devotion to a high ideal, succeeded in working his way to the very front rank of the scientific workers of his day. Again, although in his time electrical theory was being largely developed by the great French mathematicians, and mathematical analysis was regarded as an indispensable instrument of research, Faraday, without the use of a single symbol, succeeded in discovering those great fundamental facts on which the whole structure of modern electrical engineering rests, and in determining their exact quantitative relations; he further succeeded in explaining many obscure phenomena which had eluded the grasp of the great continental mathematicians. As Clerk Maxwell discovered, he was no mathematician, yet achieved results apparently only attainable by such methods.

In the small volume before us the account of Faraday's researches is admirably rendered, and is presented in a connected manner, which enables the reader to follow the trains of thought that suggested to Faraday many of his experiments. Of peculiar interest are those negative results which must now be regarded as dim foreshadowings of later discoveries—such as the attempt to discover whether a magnetic field had any effect on the refrangibility of light when applied to its source.

But interesting as is the account of Faraday's researches to those with a moderate knowledge of physics, the general reader will probably prefer to confine his attention to the earlier and later chapters in the book, in which Faraday is presented to us from the purely human standpoint. The extracts from his letters—some of which now appear for the first time—give us interesting glimpses of his inner life. His warm human sympathies, his delight in the beauties of nature, his deep and life-long attachment to his wife, his sturdy adhesion to the religious sect in which he had grown up, his relations to illustrious contemporaries—are all topics full of interest to the general reader; and they are handled in a manner well calculated to rivet his attention and enlist his sympathy. We congratulate Prof. S. P. Thompson on having successfully brought out and emphasised the quaker-like simplicity of Faraday's character, and the remarkable freedom from complexity in which he kept his life, notwithstanding the height of his fame.

Untersuchungen über Strukturen. By O. Bütschli. Pp. viii + 411; Atlas to ditto; Plates 27. (Leipzig: W. Engelmann, 1898.)

In this work the author sets forth in great detail the results of investigations, extending over six years, upon the minute structure of various bodies, products, for the most part, of the activity of living organisms. The object of these researches was to extend, and to put to the test, certain conclusions reached by the author in 1892, in his well-known work on the structure and physical constitution of protoplasm. In an appendix to the work in question he gave an account of some observations upon the minute structure of certain substances, such as gelatine and egg albumen, which exhibit the phenomena of swelling or of coagulation, and came to the conclusion that these substances possessed a minute structure which was finely honeycombed or alveolar ("Wabig"). In the present work these observations are renewed and greatly extended, both as regards minuteness of detail and in the variety of material. Besides researches upon gelatinous and coagulable substances such as gelatine, celloidin, albumen, and so forth, the author has studied the minute structure of various sphaerocrystals, of natural and

artificial cellulose structures, of starch granules, and finally of a number of natural products of animal tissues, such as chitin envelopes, spongin fibres, matrix of hyaline cartilage, and other similar structures.

To give an adequate account of these exhaustive researches, which cover more than 400 pages in the setting forth, is impossible in a short space; and it is to be regretted that the author has not anywhere given for the benefit of his readers a general summary or review of the results obtained by him. The book is, in fact, a collection of separate investigations, of which preliminary accounts have already appeared during the past seven years, bound up with an introduction and two discussions. In the introduction, the author gives an account of the order and sequence of his researches, and describes his methods of investigation, especially with regard to the technique of micro-photography. The two discussions deal with the question of the reality of the structural images obtained with the highest magnifications, and with certain phenomena of polarisation. On the other hand, the many interesting and important results obtained by the author have to be sifted out by the reader from a great mass of facts and arguments, which is no easy matter for those not specially conversant with the subject. It may be briefly stated, however, that in all the substances investigated Bütschli finds a distinct alveolar structure, which in the case of coagulable bodies is of the nature of a true foam ("Schaumig-wabig"), but which in crystallisable or sphaero-crystalline bodies is composed of an aggregation of minute globulites ("Globulitisch-wabig"). Amongst the many interesting facts which the author brings forward, attention may be specially drawn to his observations upon colloids, which when fixed in a state of tension develop appearances very similar to those seen in karyokinetic figures, suggesting the conclusion that the nuclear spindle is an expression of the effects of tension, rather than of actual differences of material between filar and interfilar substance. The author's results are supported by an atlas containing twenty-seven plates of beautifully executed micro photographs, as well as by numerous figures in the text. All those who are interested in this very important field of investigation, to which Bütschli has devoted so many years of patient and laborious research, will welcome the appearance of this work, constituting as it does a solid contribution of facts which cannot lightly be brushed aside by those who may be opposed to his theories. E. A. M.

A Manual of Library Cataloguing. By J. Henry Quinn, Librarian Chelsea Public Libraries. Pp. 164. (London: Library Supply Company, 1899.)

THIS book is in several respects favourably distinguished from others of its class that have recently seen the light. The animosities of the library world are not imported into its pages, and in several ways the writer deprecates the subordination of practical common sense to a display of learning. He does not, for instance, condemn the unfortunate reader in search of the works of George Sand to remember that her real name was Dudevant, and to look under that heading. The book is avowedly not designed for workers in a learned institution, but is most admirably adapted for those engaged in cataloguing the contents of an ordinary library. Mr. Quinn's rules are set forth with singular clearness, and endowed with a wise elasticity. He is on the whole in favour of the "dictionary" system, wherein each book may be found, under a single alphabetical arrangement, under its title, the name of its author, and the particular portion of human knowledge with which it deals, but he also gives an adequate account of the system of "classified catalogues." An appendix gives most valuable help to the librarian in his dealings with the printer of his catalogue, and gives completeness to a most valuable little work.